DDcGAN: A Dual-Discriminator Conditional Generative Adversarial Network for Multi-Resolution Image Fusion

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Abstract

In this paper, we proposed a new end-to-end model, termed as dual-discriminator conditional generative adversarial network (DDcGAN), for fusing infrared and visible images of different resolutions. Our method establishes an adversarial game between a generator and two discriminators. The generator aims to generate a real-like fused image based on a specifically designed content loss to fool the two discriminators, while the two discriminators aim to distinguish the structure differences between the fused image and two source images, respectively, in addition to the content loss. Consequently, the fused image is forced to simultaneously keep the thermal radiation in the infrared image and the texture details in the visible image. Moreover, to fuse source images of different resolutions, e.g., a low-resolution infrared image and a high-resolution visible image, our DDcGAN constrains the downsampled fused image to have similar property with the infrared image. This can avoid causing thermal radiation information blurring or visible texture detail loss, which typically happens in traditional methods. In addition, we also apply our DDcGAN to fusing multi-modality medical images of different resolutions, e.g., a low-resolution positron emission tomography image and a high-resolution magnetic resonance image. The qualitative and quantitative experiments on publicly available datasets demonstrate the superiority of our DDcGAN over the state-of-the-art, in terms of both visual effect and quantitative metrics. Our code is publicly available at https://github.com/jiayi-ma/DDcGAN.